

First record of *Latrodectus hesperus* Chamberlin & Ivie, 1935, Western Black Widow (Araneae, Theridiidae), in Slovakia

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Abstract. An alien spider species, *Latrodectus hesperus* Chamberlin & Ivie, 1935, is reported from Slovakia for the first time. The spider was accidentally transported to northern Slovakia with goods, and it was found in synanthropic habitat. This record confirms the route through which spiders of the genus *Latrodectus* are imported into Europe. Characteristic features, along with photographs of the habitus and copulatory organs, are presented.

Key words. Arachnida, Central Europe, introduction, medically significant spiders, non-native species

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INTRODUCTION

The spread of non-native species is a highly important topic, whether they are plants or animals. Globalization has greatly facilitated the distribution of numerous species through international trade, tourism, and the transport of various materials (Kobelt and Nentwig 2007; Meyerson and Mooney 2007; Hulme 2009; Abdullah et al. 2024). In some cases, the spread of alien species manifests as biological invasions, causing significant impacts on native ecosystems, human health, and the economy (Gebauer et al. 2018). Conversely, certain alien species, referred to as naturalized species, establish themselves in new environments without negatively affecting native ecosystems (Zhao et al. 2022). Meanwhile, other alien species enter regions outside their native range as isolated individuals but fail to establish viable populations (Nentwig 2015; Gajdoš et al. 2018).

Compared to plants, vertebrates, or other invertebrates, spiders often receive less attention, primarily due to their small size, cryptic life histories, and the limited understanding of their impact on native ecosystems (Sacher 1983; Thaler and Knoflach 1995). Nevertheless, some alien species, in European conditions for example *Erigone autumnalis* Emerton, 1882, *Mermessus trilobatus* Emerton, 1882, and *Ostearius melanopygius* (O. Pickard-Cambridge, 1880), are capable of expansive dispersal in different types of habitats and can be considered as invasive species (Benz et al. 1983; Hänggi 1990; Růžička 1995; Dolanský et al. 2009; Narimanov et al. 2021). However, most alien spider species in Europe, such as *Coleosoma floridanum* Banks, 1900, *Loxosceles laeta* (Nicolet, 1849), and *Scytodes fusca* Walckenaer, 1837, are typically confined to greenhouses, building interiors, or other heated areas in their new environments (Huhta 1972; Šestáková et al. 2014; Plakkhina et al. 2022). Alternatively, some species represent accidental introductions of solitary individuals, as in the cases of *Meri sanctivincenti* (Simon, 1898), *Phidippus regius* C.L. Koch, 1846, or *Phoneutria boliviensis* (F.O. Pickard-Cambridge, 1897) (Schmidt 1971; Jäger and Blick 2009; Nentwig 2015). While these instances generally pose no threat to native ecosystems, certain species may occasionally present risks to human health. This includes members of the genus *Latrodectus* Walckenaer, 1805, commonly known as widows (Nentwig 2015).

The genus *Latrodectus* belongs to the family Theridiidae, which comprises 129 genera and over 3,000 species of small to medium-sized spiders worldwide (Vanuytven et al. 2021; WSC 2024). This genus includes 35 species distributed across tropical and subtropical regions (WSC 2024). Widows are infamous for their bites, which can be harmful to humans (D'Amour et al. 1936; Maretic 1965; Knoflach and Harten 2002). Their venom contains latrotoxin, which may cause systemic effects (latrodectism), including severe muscle pain, abdominal cramps, diaphoresis, tachycardia, muscle spasms, and other symptoms (Ushkaryov et al. 2008). Fatal cases resulting from widow bites are rare. For example, no deaths caused by widow bites have been reported in the United States since 1983 (Mowry et al. 2013).

Latrodectus hesperus Chamberlin & Ivie, 1935, a black widow species widespread in North America, has been introduced to Israel and Korea (Nentwig et al. 2024) and, in at least a few instances, to Europe (Noordijk 2016; Collier et al. 2023).



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Here, we provide information about the record of the alien species *L. hesperus* in Slovakia, expanding the current knowledge of accidental introduction of *Latrodectus* species into Europe.

METHODS

The studied material was collected in Ružomberok, northern Slovakia (Figure 1A). A single female *Latrodectus hesperus*, along with an egg sac, was discovered inside a building within a consignment of goods (machine parts) originating from San Bernardino, California, USA. The specimen was captured and maintained alive under laboratory conditions, where it produced eight fertile egg sacs. Juveniles of both sexes were reared to maturity to facilitate the identification of the species, as an adult male was required for accurate determination (Figure 2).

Individuals from the second generation (10 males and 10 females) were also used for species identification and imaging. Photographs of live specimens were taken using a Fujifilm FinePix S4500 digital camera. Microscopic images of the habitus and copulatory organs, as well as measurements, were obtained using an Olympus SC 100 camera attached to an Olympus SZX16 stereomicroscope and processed with Olympus Stream Basic software. Images were captured at different focal planes and combined into stacks using Zerene Stacker. All measurements are provided in millimeters.

The specimens are either kept alive or preserved in 70% ethanol in the collections of the Institute of Landscape Ecology of the Slovak Academy of Sciences in Nitra (ILE SAS, curator: P. Purgat). Nomenclature follows the World Spider Catalog (WSC 2024).

Map data on the native distribution of *L. hesperus* and non-native records of *Latrodectus* species in Europe were compiled from the literature (Ross 1988; O'Connor and Holmes 1993; Nolan 2012; Decae and Moeliker 2013; Noordijk 2016; Bosmans and Van Keer 2017; Rozwałka et al. 2017; Žitko and Bakić 2018; Collier et al. 2023; GBIF 2024). The base map source includes Esri, Maxar, Earthstar Geographics, and the GIS User Community.

RESULTS

Theridiidae Sundevall, 1833

Latrodectus hesperus Chamberlin & Ivie, 1935

Figures 2–7

Latrodectus hesperus—Cabrera-Espinosa and Valdez-Mondragón 2021: 4, figs. 11–13, 24–26, 34–37 (♂♀). For the complete list of taxonomic references, see WSC (2024).

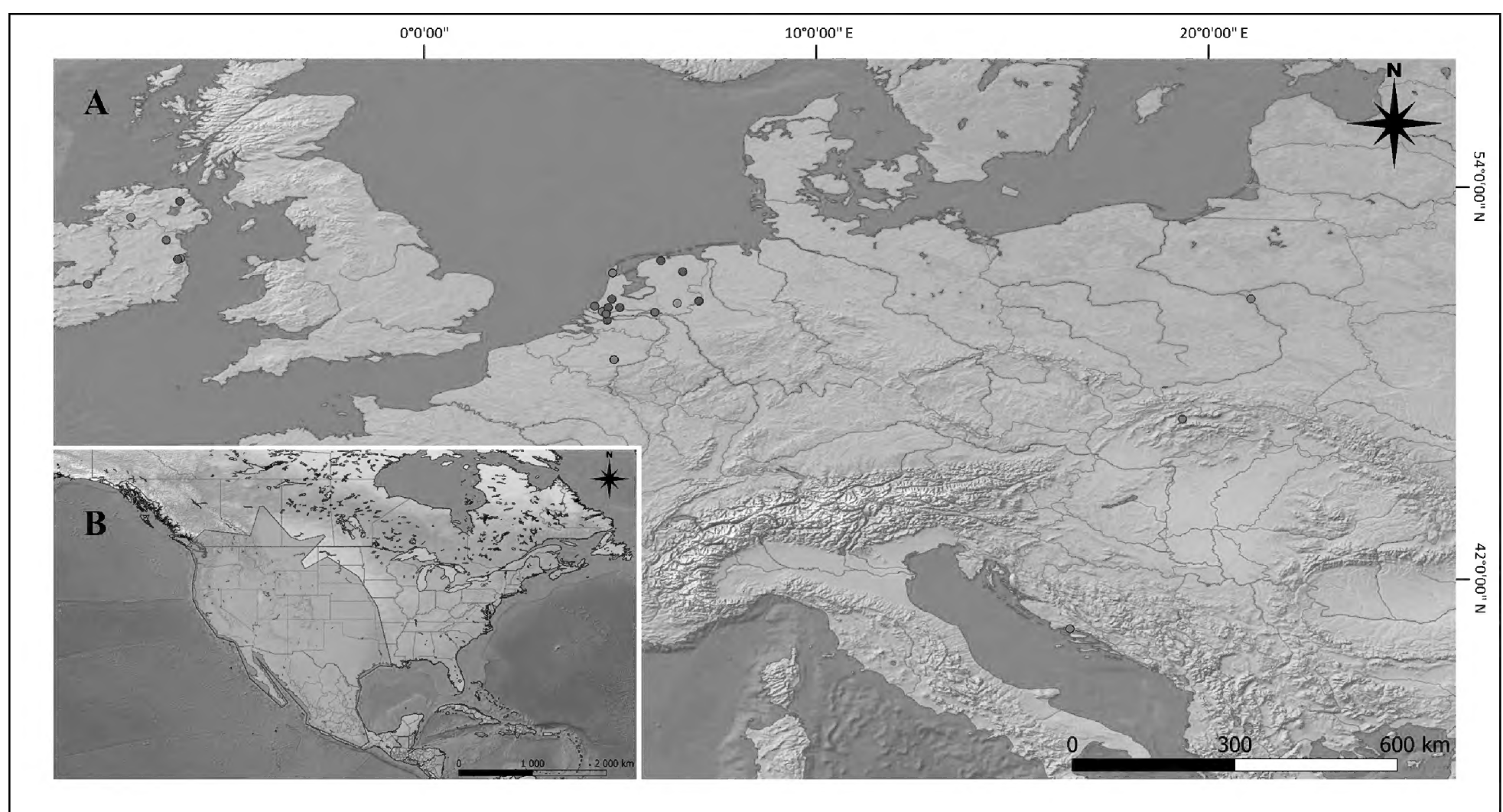


Figure 1. A. Records of non-native distribution of species of the genus *Latrodectus* in Europe: *L. geometricus* = red circles [Ireland, Belgium, Netherlands, Poland]; *L. hasselti* = yellow circles [Belgium, Croatia, Netherlands]; *L. hesperus* = blue circles [Ireland, Netherlands], dark blue circle [new record from Slovakia]; *L. hesperus/mactans* = green circles [Ireland, Netherlands]; *L. tredecimguttatus* = purple circle [Netherlands]; orange lines = borders of countries. **B.** Original distribution of *L. hesperus* in Americas.

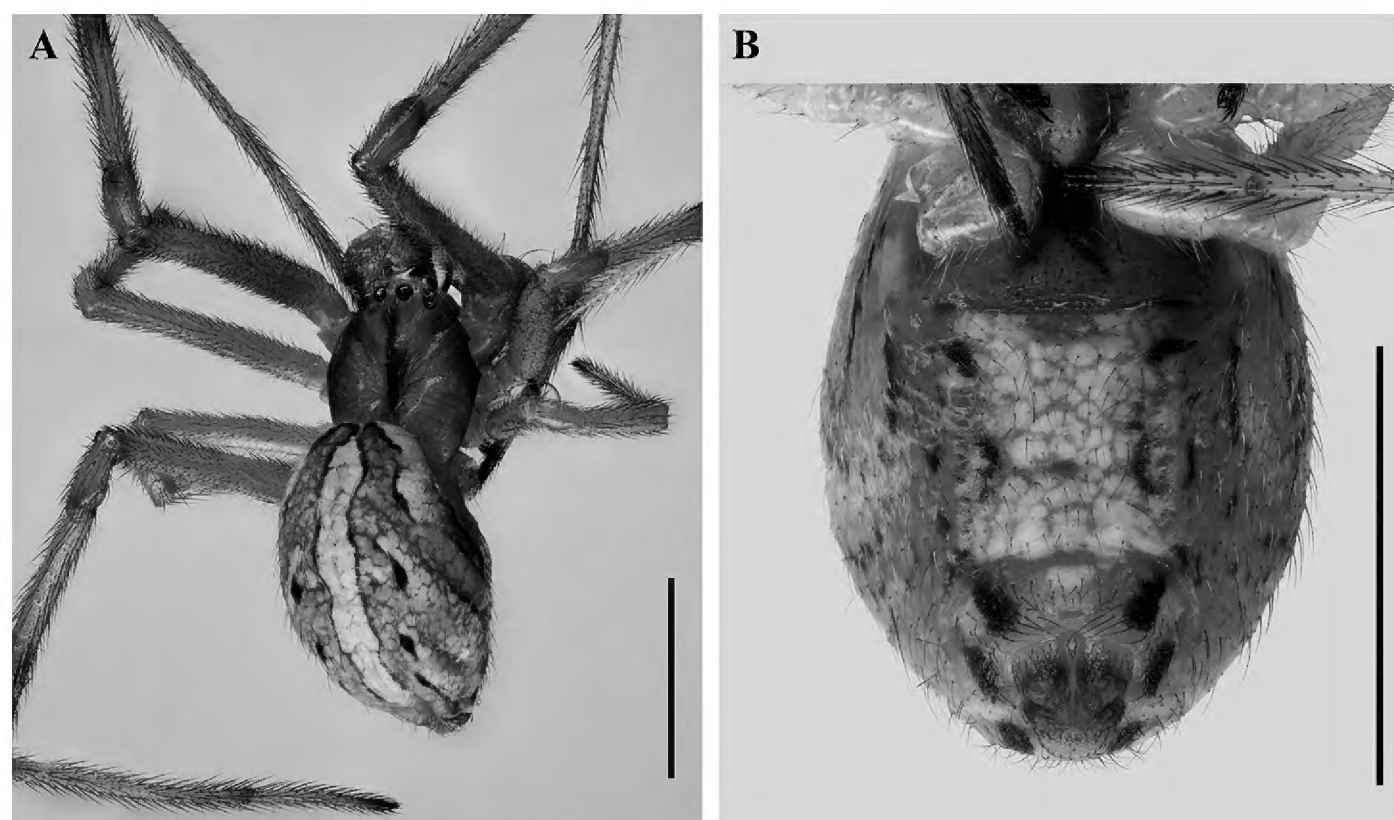


Figure 2. *Latrodectus hesperus* Chamberlin & Ivie, 1935, male of F1 generation from specimen introduced to Slovakia, habitus. **A.** Dorsal view. **B.** Ventral view of opisthosoma. Scale bars: 1 mm.

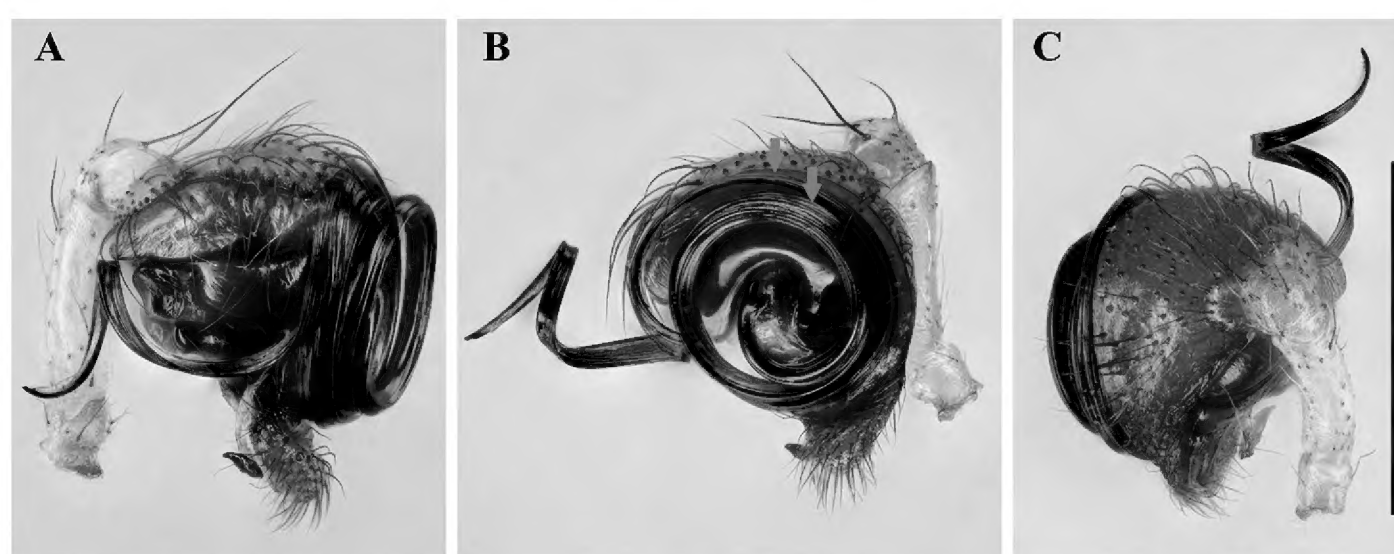


Figure 3. *Latrodectus hesperus* Chamberlin & Ivie, 1935, male of F1 generation from specimen introduced to Slovakia, palp (two embolus coils marked with arrows). **A.** Retrolateral view. **B.** Ventral view. **C.** Prolateral view. Scale bar: 1 mm.

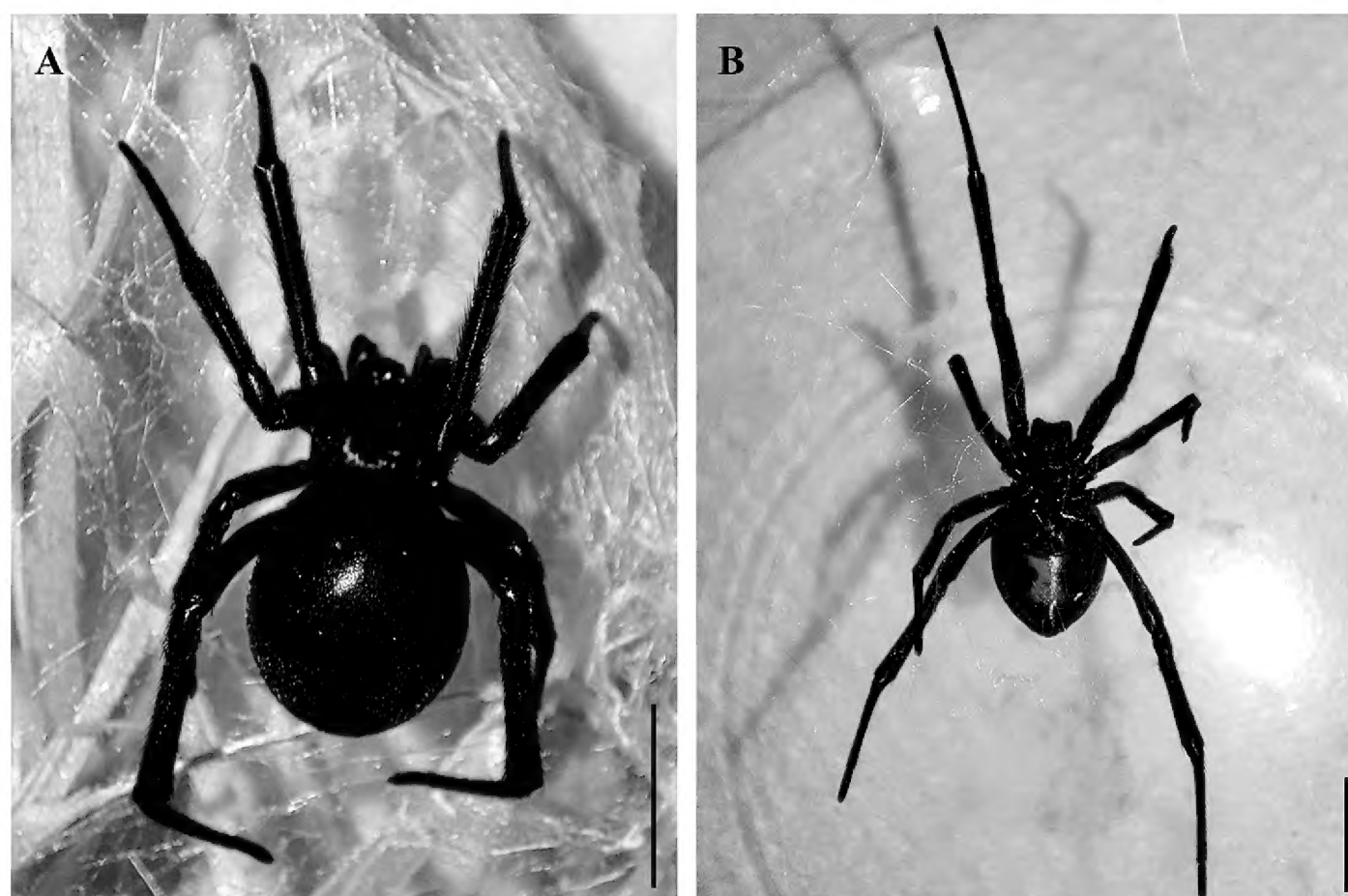


Figure 4. *Latrodectus hesperus* Chamberlin & Ivie, 1935, female introduced to Slovakia, habitus. **A.** Dorsal view. **B.** Ventral view. Scale bar: 5 mm.

New record. SLOVAKIA – NORTHERN SLOVAKIA • Ružomberok; 49°05.286'N, 019°17.488'E, 480 m a.s.l.; 31.X.2023; V. Blaho leg.; interior of building; individual collecting; 1 ♀, ILE SAS-2004 [other specimens studied. 10 ♂, ILE SAS-2005–2014; 10 ♀, ILE SAS-2015–2024] (Figure 4).

Identification. **Male palp:** embolus with 2 coils (Kaston 1970) (Figure 3). **Epigyne:** vulva with 3 outside coils of

Figure 5. *Latrodectus hesperus* Chamberlin & Ivie, 1935, female of F1 generation from specimen introduced to Slovakia. **A.** Epigyne and the hourglass marking on ventral side of opisthosoma. **B.** Vulva (3 outside coils of copulatory ducts marked with arrows). Scale bars: A = 1 mm, B = 0.5 mm.

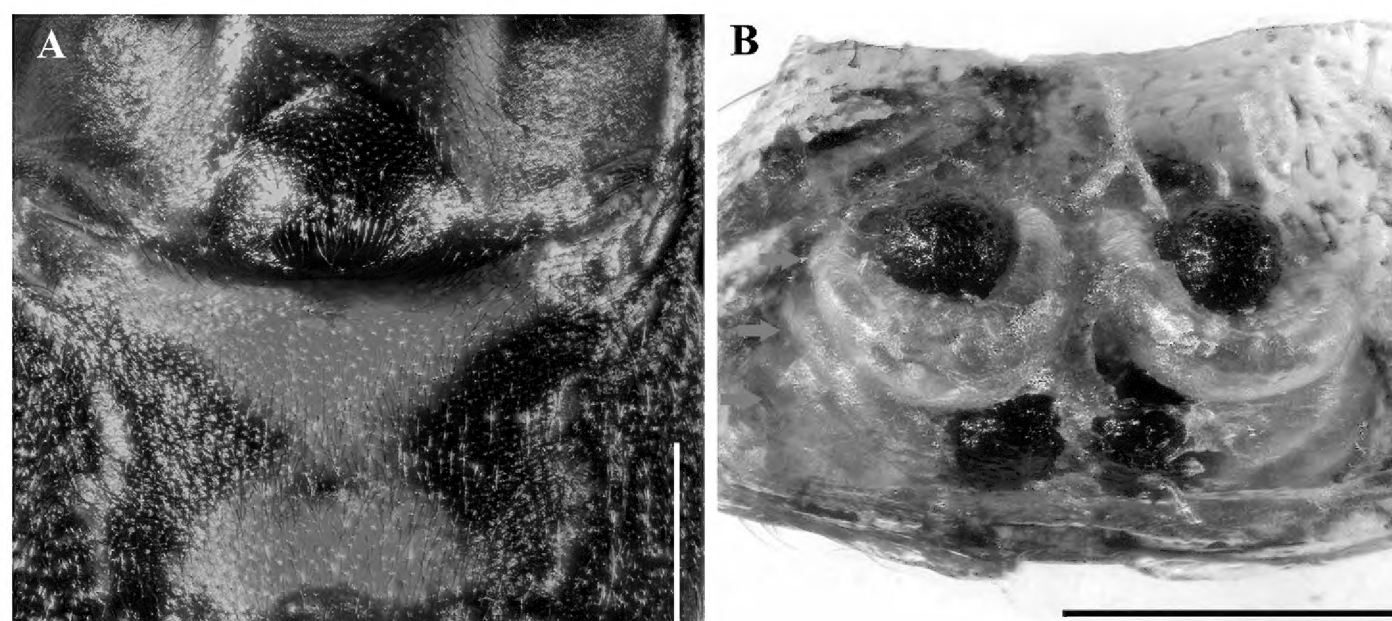
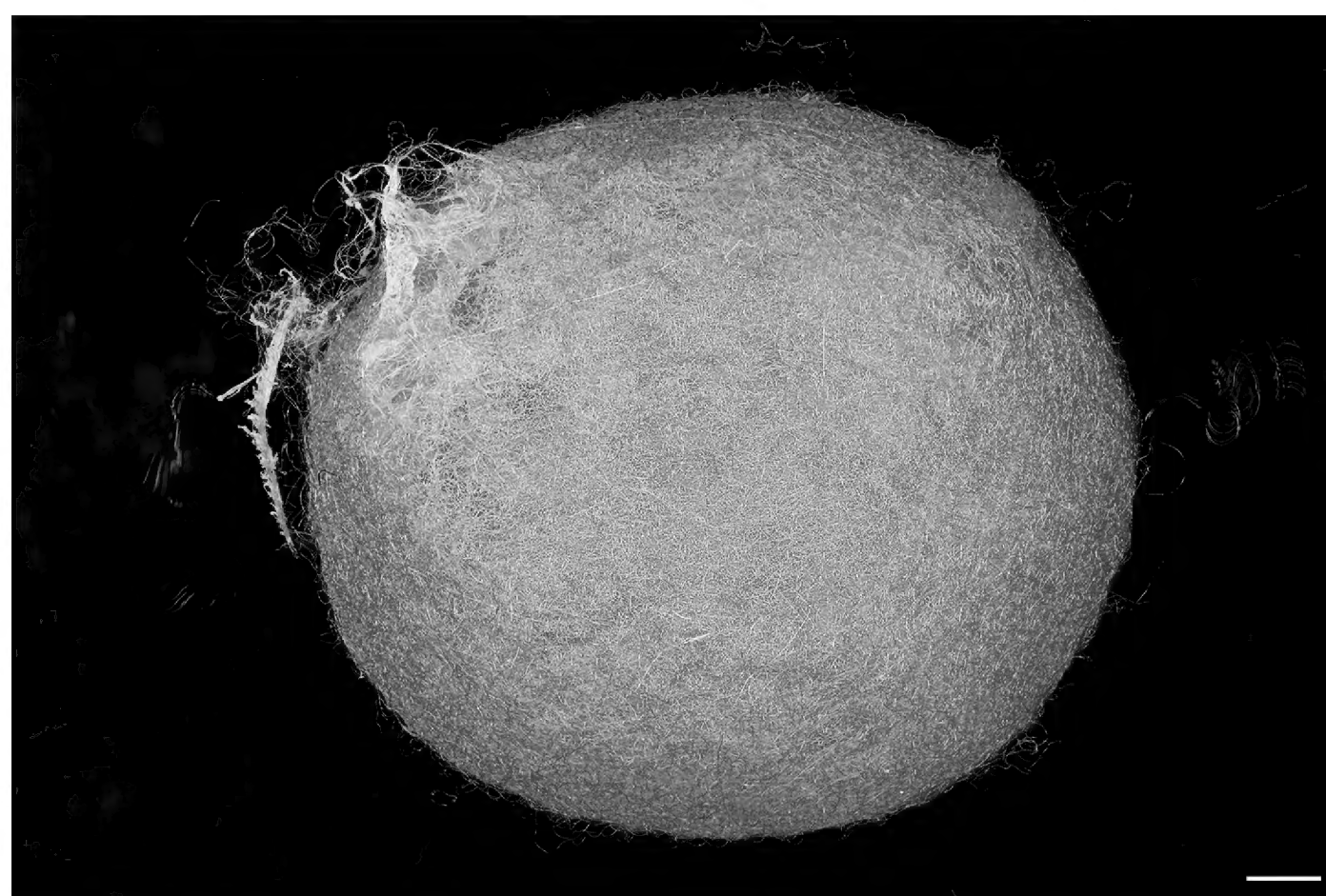


Figure 6. *Latrodectus hesperus* Chamberlin & Ivie, 1935, egg sac. Scale bar: 1 mm.



copulatory ducts (Kaston 1970) (Figure 5). **Egg sac:** pear-shaped, often spread at the top, 13–14 mm in height, 10–20 mm in diameter, tough papery texture, creamy yellow to light tan (Kaston 1970) (Figure 6). Juveniles: ground color of first instar juvenile's carapace dusky grayish yellow, ground color of opisthosoma creamy white, some individuals showing a light tan to olive-green hue toward the sides (Figure 7). **Similar species:** in California, where *L. hesperus* is native, three other species of *Latrodectus* occur: *L. mactans* Fabricius, 1775 (Caruso et al. 2021), the alien *L. geometricus* C.L. Koch, 1841 (Vetter et al. 2012), and the non-native Floridian species *L. bishopi* Kaston, 1938 (Carel 2001; GBIF 2024). Identification of adult *L. mactans* and *L. hesperus* by habitus is unreliable due to high variability. The female internal sexual structures (spermathecae and copulatory ducts) are very similar. However, the male *L. mactans* embolus differs from the *L. hesperus* embolus in having three coils (Kaston 1970; Cabrera-Espinosa and Valdez-Mondragón 2021). The dorsal abdominal patterns of *L. hesperus* include an anterior white band on the opisthosoma, which is consistently hook-shaped, whereas in *L. mactans*, this pattern is rare. The egg sac of *L. mactans* almost always has a grayish tinge, often distinctly so. First-instar juveniles of *L. mactans* have a carapace that is predominantly yellowish with gray suffusion, and an opisthosoma that is orange-red with a pair of anterior white bands and two pairs of diagonal white bands extending laterally (Kaston 1970).

Latrodectus geometricus is easily distinguishable by its opisthosomal pattern (Keegan 1955). Its vulva has three external coils, similar to *L. hesperus*, but the spermathecae are positioned parallel. The embolus of *L. geometricus* has three to nearly four coils (Cabrera-Espinosa and Valdez-Mondragón 2021). The egg sac is non-papery and quite translucent (Kaston 1970), covered with short conical spines (Nolan 2012).

Latrodectus bishopi shares the same number of embolus coils (i.e., two) and external vulval coils (i.e., three) as *L. hesperus*. However, its cephalothorax and legs exhibit bright-orange, yellow, or red coloration (Kaston 1938). Ventrally, the opisthosoma of *L. bishopi* displays none or only one or two patches instead of a complete hourglass pattern (cf. Figure 5A) (Kaston 1938; McCrone and Levi 1964). Its egg sac has a soft texture and is white in color (McCrone and Levi 1964).

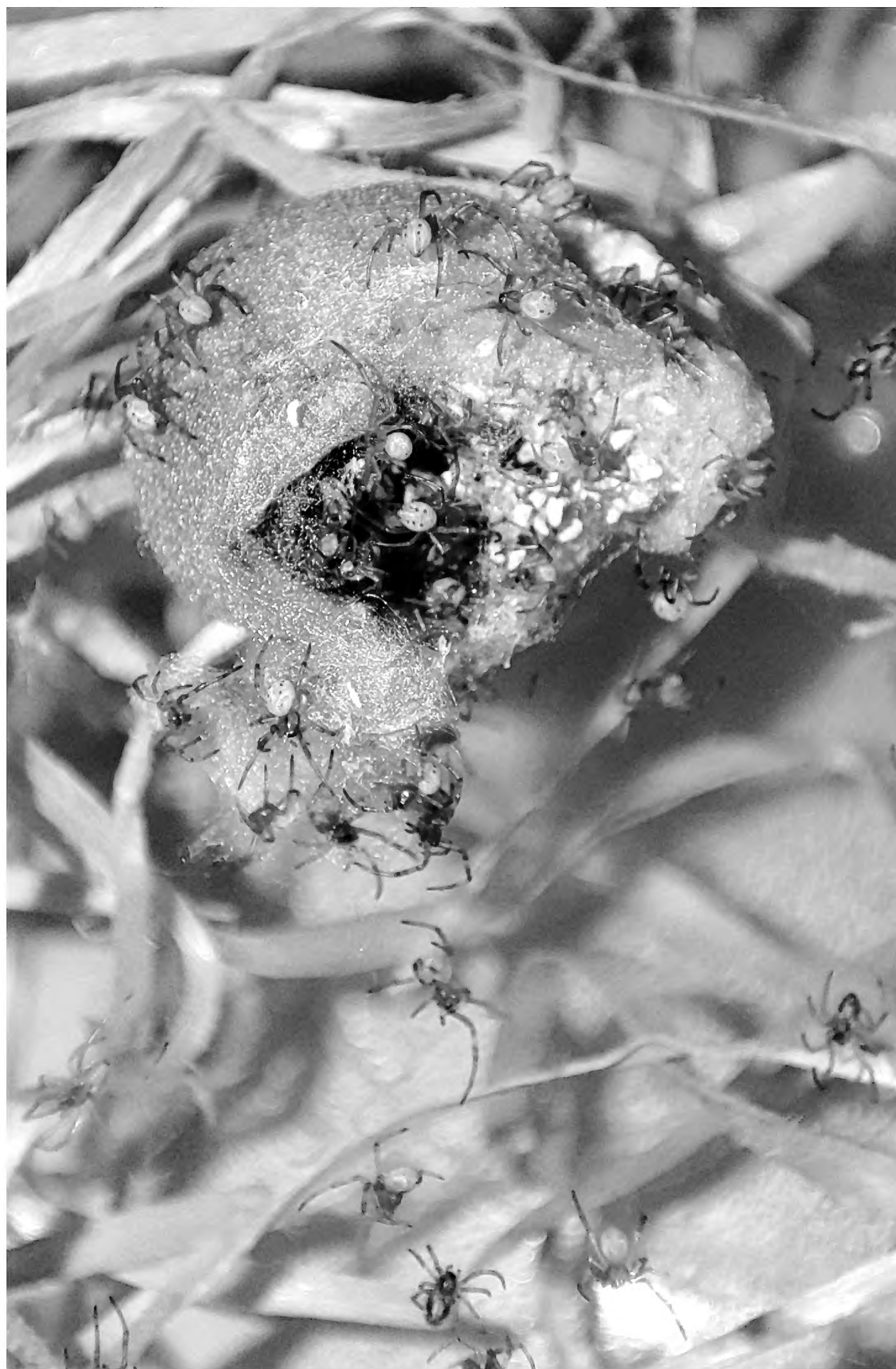


Figure 7. *Latrodectus hesperus* Chamberlin & Ivie, 1935, juveniles of F1 generation from specimen introduced to Slovakia.

Measurement of the specimens (in mm). ♂: body length 1.97–2.37; carapace 0.84–0.95 long, 0.58–0.76 wide; opisthosoma 1.13–1.42 long, 0.51–0.64 wide. ♀: body length 10.56–10.62; carapace 3.65–3.34 long, 3.21–3.55 wide; opisthosoma 6.91–7.91 long, 5.02–5.90 wide. 10 males and 10 females were measured.

Distribution. The species is native to the western regions of North America. Its range extends from southwestern Canada (British Columbia, Alberta, Saskatchewan) in the north (Curran-Sills et al. 2021), across the western United States, and to southern Mexico in the south (Valdez-Mondragón and Cabrera-Espinosa 2023), with accidental introductions reported in Maine (Jennings and McDaniel 1988) (Figure 1B). Alien populations of this species have been recorded in Israel (Levy 1998) and South Korea (Choi et al. 2019). In Europe, it has been documented in the Netherlands and Ireland (Noordijk 2016; Collier et al. 2023) (Figure 1A).

Comment. The genus *Latrodectus* includes 35 species distributed across all continents, except Antarctica (WSC 2024). In Europe, only three species are native: *L. tredecimguttatus* (Rossi, 1790), found in the Mediterranean region, Ukraine, the Caucasus, and Russia (Nentwig et al. 2024); *L. dahli* Levi, 1959, occurring in Cyprus (Bosmans et al. 2019); and *L. lilianae* Melic, 2000, found in Spain (Branco et al. 2019).

The other four *Latrodectus* species reported in Europe are alien and have not formed established populations. The African *L. geometricus* C.L. Koch, 1841 has been recorded in Poland (Rozwałka et al. 2017), the Netherlands (Noordijk 2016), Belgium (Bosmans and Van Keer 2017), and Ireland (Nolan 2012) (Figure 1A). The Australian and Southeast Asian *L. hasselti* Thorell, 1870 has been found in Belgium (Bosmans and Van Keer 2017), the Netherlands (Noordijk 2016), and Croatia (Žitko and Bakić 2018) (Figure 1A).

The American *L. hesperus* has been recorded in the Netherlands (Noordijk 2016) and Ireland (Collier et al. 2023). Another American species, *L. mactans* (Fabricius, 1775), has been reported in Belgium (Bosmans and Van Keer 2017) and Ireland (Collier et al. 2023), although these records are doubtful and could be misidentifications of *L. hesperus*. Additionally, there is a record of *L. tredecimguttatus* in the Netherlands (Noordijk 2023), where it is also considered non-native (Figure 1A).

DISCUSSION

The new record of *Latrodectus hesperus* in Slovakia marks its presence in three European countries (Noordijk 2016; Collier et al. 2023). The mode of introduction into Europe was similar in all cases. An adult female was transported to Slovakia with goods from California, while three individuals were imported into Ireland in a vintage van, also originating from California (Collier et al. 2023). Several other instances of this species being introduced through transported goods—such as vintage cars, machinery, and plants—are documented from the Netherlands (Noordijk 2016).

Earlier records of black widows in Europe may involve misidentifications. Adult and subadult females previously identified as *L. mactans* might actually have been *L. hesperus*, given that these two species cannot be reliably distinguished based on morphological characteristics alone (Cabrera-Espinosa and Valdez-Mondragón 2021). For instance, seven introduction events have been recorded in the Netherlands (Noordijk 2016), and two questionable records from Ireland involve shipments of grapes and empty beer containers (Ross 1988; O'Connor and Holmes 1993).

Individuals of *L. hesperus* are known to survive accidental transport for over a year, even under suboptimal conditions. For example, one individual in Ireland survived in an empty van imported in January 2019 and was captured in October 2020 (Collier et al. 2023). However, this spider showed signs of malnutrition and dehydration. Similarly, the individual found in Slovakia was in poor condition, suggesting limited access to food and water after egg sac formation. The duration of storage for this specimen remains uncertain.

We hypothesize that the species' ability to endure adverse conditions for extended periods significantly increases the likelihood of human interaction, potential biting incidents, and, in suitable habitats, eventual establishment of local populations. Additionally, the high fertility of female *Latrodectus* species enhances their potential for population establishment. For instance, *Latrodectus geometricus* can produce up to 30 egg sacs (Bouillon 1957), while *L. hesperus* has been recorded producing a maximum of 21 (Kaston 1970). The female found in Slovakia produced 10 egg sacs during nine months of laboratory rearing, including one damaged sac and one unfertilized sac.

Given the synanthropic tendencies of *L. hesperus*, we hypothesize that similar introductions of gravid females could lead to the establishment of local breeding populations in buildings. A comparable scenario was proposed by Jennings and McDaniel (1988) for this species in Maine (New England, USA), where winter temperatures are similar to those in the region where the Slovakian specimen was found (Weather and Climate 2024). Collier et al. (2023) also suggest that the individuals introduced to Ireland might have survived two winter seasons in sheltered, man-made structures. From the northern part of its range in North America (British Columbia, Canada), female *L. hesperus* are known to survive 2–3 years (Salomon et al. 2010).

However, unlike the Slovakian specimen, no egg sacs or subsequent generations of *L. hesperus* were detected in Ireland (Collier et al. 2023) or the Netherlands (Noordijk 2016). It remains uncertain whether the species could establish itself in these regions. Although spiderlings hatched and matured successfully under laboratory conditions from the egg sacs of the Slovakian female, it is doubtful whether they could have done so under the environmental conditions in which the original specimen was found.

At present, no introduced population of any *Latrodectus* species is known to have successfully established in Europe (Nentwig et al. 2024). However, an increasing number of introduction events has been reported (Kobelt and Nentwig 2007), suggesting that establishment may eventually occur (Nentwig 2015). A more comprehensive understanding of the long-term survival and reproductive potential of *L. hesperus* under European conditions will likely emerge with additional records.

The discovery of *L. hesperus* in Slovakia contributes valuable data to the ongoing documentation of widow spider introductions in Europe. Given its synanthropic distribution and medically significant bite, cases of introduction of this species warrant close monitoring and further study.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: PP. Data curation: PP, LŠ. Formal analysis: PP, LŠ. Investigation: PP. Methodology: PP. Resources: PP, LŠ. Supervision: PP. Visualization: PP, LŠ. Project administration: PP. Software: PP, LŠ. Writing – original draft: PP. Writing – review and editing: LŠ.

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Data availability

All data that support the findings of this study are available in the main text.

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